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ABSTRACT

An experiment was conducted in a preservice teacher education course in materials for teaching at the East Tennessee State University to determine whether or not students would gain more cognitive information while developing psychomotor skills when using self-instructional techniques as compared with those students using a traditional lecture-demonstration method. Students enrolled in the course completed a 36 multiple choice preinstructional inventory. Both the experimental and control groups were permitted assigned specific access time to the self-instructional lab where all equipment was housed. After all the subjects had completed the module, a posttest was administered. An analysis of covariance made adjustments for initial inequalities between the experimental and control groups since they were not randomly selected or matched pairs. The computation showed that the experimental group achieved a greater gain in cognitive information over the control group at the .05 level of significance. It was concluded that mediated self-instruction was superior to the lecture-demonstration method insofar as the experiment was structured. (HMD)

ED 096277

COMPARISON OF LECTURE-DEMONSTRATION WITH SELF-INSTRUCTION AS THEY AFFECT COGNITIVE INFORMATION WHEN DEVELOPING PSYCHOMOTOR SKILLS IN A COMPETENCY-BASED MODULE

CORE MODULE IN APPLIED EDUCATIONAL RESEARCH AND EVALUATION

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Chapter I

INTRODUCTION

In a period of time when accountability is the Shibboleth for all educators, the need for applying educational technology to instructional techniques is highly desirable as a defense. This technology also makes possible numerous self-instructional modes which allow the student greater freedom to explore new frontiers, review materials already covered, and develop a mastery of subject matter never before possible.

Determining, to one's own satisfaction and the satisfaction of those charged with the responsibility of governing education, the effectiveness of mediated self-instruction and the traditional lecture-demonstration technique forms the scope of this practicum.

I. THE PROBLEM

This research project was conducted to determine if there would be a significant difference between two instructional techniques employed in a competency-based, pre-service teacher education course.

Two classes totaling one hundred fifty-two students were divided into a control group that was taught by the conventional lecture-demonstration method and an experimental

group that used self-instructional materials while developing psychomotor skills.

The experiment was conducted to determine if there would be a significant difference between the experimental and control groups in achievement of cognitive information in the course 3470, Materials for Teaching.

II. THE HYPOTHESIS

The experiment was expected to show a greater gain in achievement of cognitive information by the group using self-instructional materials while developing psychomotor skills in the use of instructional hardware.

III. VARIABLES

In order to produce a valid and reliable study, a number of variables had to be isolated and identified.

The Independent Variable

The independent variable was the treatment given to the experimental group which consisted of a packet of self-instructional materials that was used in learning how to operate four different pieces of instructional hardware.

Entrance level knowledge was measured by a multiple choice, thirty-six item, pre-instructional inventory designated as a covariant.

The Dependent Variable

The dependent variable was the achievement scores

produced on a post-test equal to the pre-instructional inventory.

Moderator Variables

There were at least two variables that were thought to affect the study to some degree. Mechanical aptitude and manual dexterity, although not specifically measured on the pre-instructional inventory or the post-test, could moderate the students' attitude and, consequently, their retention of cognitive information.

Control Variables

In order to offset any differences that might arise due to sex or intelligence, and to facilitate scheduling, the two classes were divided into four groups each and by using a Latin square, they were designated as either experimental (four groups) or control (four groups).

Intervening Variable

At this writing there were no reliable instruments to measure a student's cognitive learning style. However, this does not preclude the phenomenon. It was believed that the student's cognitive style would affect his performance due to his preference for one learning style over another. Also, the perceived purpose or relevance of the course, as each student viewed it, could affect the outcome.

IV. BACKGROUND AND SIGNIFICANCE OF THE STUDY

The course in which the study was conducted was Education 3470, Materials for Teaching. It was an upper division undergraduate teacher education course required of all elementary and secondary education majors at East Tennessee State University, Johnson City, Tennessee. There were two sections of the class offered during the quarter and they were divided into four groups each. The course was team-taught by four different instructors. The areas covered were: (1) library science, (2) operation of instructional hardware, (3) educational statistics, and (4) textbooks and community resources.

The study was conducted in only one section of the course, the operation of instructional hardware.

The College of Education is conducting a study and developing plans to implement a competency-based teacher education program that would drastically change the manner in which all classes are taught and the sequence in which the student would encounter them.

In such a program, self-instructional packets would be the heart of each module of instruction within each component area. To facilitate this program, Dr. Ted C. Cobun, Director of the Division of Instructional Communication, Dr. Clyde Orr, Chairman of the Department of Education, and Dr. Scott Honaker, Dean of the College of Education have given approval and encourage such research.

Not only do techniques of instruction need to be developed that will facilitate a competency-based program,

but economies of time and resources need to be realized. Therefore, if the developing of psychomotor skills and the acquisition of cognitive information pertaining to those skills can be achieved by self-instructional techniques without formal classroom instruction, then the worth of this study will have been realized.

V. DEFINITION OF TERMS

Behavioral objectives. This term referred to the specific behavior that must be demonstrated by the learner after completion of that segment of instruction designed to implement the prior stated objective. These kinds of objectives are at the heart of competency-based or performance-based education.

Cognitive domain. That area of one's learning in which facts, figures, ideas, knowledge, and et cetera, were grouped according to the scheme devised by Bloom, Krathwohl, and others and they are called the cognitive domain.

Competency-based program. This was a teaching/learning strategy where the usual cognitive, affective, and psychomotor domains covered in any course had to be demonstrated or performed by each individual student according to a predetermined level. It implied that students must possess certain entrance behaviors for each module or component of instruction. The students' progress would usually be self-paced. Modes of instruction were varied enough for each student to choose one of several means of achieving

the objectives. Time was not held constant as in traditional classes.

Course 3470. This was a required course in the preparation of public school teachers in Tennessee. Titled, Materials for Teaching, it was composed of four units of instruction each taught by a different instructor and each unit lasted approximately two and one-half weeks. The units were referred to as modules and were composed of: (1) library science, (2) operation of instructional hardware, (3) educational statistics, and (4) textbooks and community resources.

Instructional hardware module. One of four units (modules) of instruction in the course 3470, each having been taught by a different instructor. This segment included instruction in the operation, care, and utilization of four pieces of instructional hardware: (1) a 16mm movie projector, (2) an overhead projector, (3) an audio tape recorder, and (4) a filmstrip projector.

Laboratory. The self-instructional equipment operations laboratory housed all types of instructional hardware, media, and accessories necessary for the learner to develop operational skills. Normally, the lab contained some self-instructional media, but for the duration of the experiment, no self-instructional materials were placed in the lab except during certain days when the experimental groups were allowed to utilize the facility.

Lecture-demonstration method. As used in this project,

the lecture-demonstration method consisted of an instructor verbally presenting information to the students which was necessary to achieve part or all of the behavioral objectives. Demonstrations were made on the instructional hardware which the students in the control group were using each class session.

Psychomotor domain. This term referred to that area of one's learning classified as involving physical motor skills where the person manipulated things or was involved in the development of physical skills. This was identified as a part of Bloom's taxonomy.

Self-instructional materials. These consisted of teacher-made and commercially produced instructional materials written or designed in such a way that the user could choose one of several different types to help him gain the knowledge, skills, and insights necessary to achieve the behaviorally stated objectives for any segment of instruction.

Skills test. All students using the lab were required to pass a skills test on each piece of instructional hardware studied. A student assistant assigned to the lab and trained to administer the skills tests would, upon the request of the learner who had practiced sufficiently, use a check sheet to see if the learner could perform all skills necessary to the successful operation of that piece of hardware.

Upper division courses. Course work at East Tennessee State University has been divided into lower and upper division work. Courses numbered 1000-2000 were freshman and sophomore level and classified as lower division. Courses numbered 3000-4000 were junior and senior level and classified as upper division.

VI. LIMITATIONS OF THE STUDY

Students used in this study were taken from an intact group. The students were allowed to enroll for the course, 3470, at anytime after they had attained upper division status (completed all freshman and sophomore courses). Consequently, the major limitation was that the sample was not randomly selected.

An additional limitation existed because no pilot study was undertaken, due to the time factor involved, which would have enabled the researcher to develop the most effective type of self-instructional materials.

The study was limited to the operation of instructional hardware module of the 3470 component. This would restrict the applicability of the research findings to similar situations where cognitive and psychomotor skills are taught.

No measuring of the psychomotor skills involved in passing the skills test was undertaken because of the problems associated with the subjective skills test administration and evaluation. Also, there was not an

inventory taken of student opinions as to their preference for either technique of instruction since the design of the study provided for only half of the group to experience self-instruction.

VII. BASIC ASSUMPTIONS

It was assumed that no differences existed between male and female mechanical aptitudes. Also, it was assumed that difference in intellectual abilities would affect the study and would be adjusted by using the analysis of covariance.

The assumption was made that each group would take as much time as would be needed in the laboratory to successfully pass the skills tests. Each group had five laboratory sessions assigned within which to practice but additional sessions were given until the operation of all four pieces of equipment had been accomplished.

VIII. PROCEDURES FOR COLLECTING DATA

Students enrolled in the two sections of 3470 were divided into four groups each at the initial class meetings, September 20 and 21, 1973. Each group was assigned to a particular instructor for the first module of instruction and was rotated through the remaining modules approximately every two and one-half weeks. A Latin square was used as a means of organizing and rotating the sections through the quarter's work (see data in appendix A).

Table 1

A Latin Square Design to Organize and Move Sections Through the Class

3470 Section 001 MWF*				
Place	1st 8 Days	2nd 7 Days	3rd 8 Days	4th 7 Days
E403	A	B	C	D
E407	B	C	D	A
L415	C	D	A	B
E203	D	A	B	C

3470 Section 002 TT*				
Place	1st 5 Days	2nd 5 Days	3rd 5 Days	4th 5 Days
E403	E	F	G	H
E407	F	G	H	E
L415	G	H	E	F
E203	H	E	F	G

*MWF classes meet for 50 minutes.

* TT classes meet for 75 minutes.

There was a pre-instructional inventory administered to each of the four groups in both classes as each one rotated into the operation of instructional hardware portion of the course, 3470. The pre-instructional inventory administration was as follows:

Table 2

A Schedule for Administering the Pre-test

MWF Class	TT Class
September 21 - Group D_e	September 20 - Group H_c
October 10 - Group A_c	October 9 - Group E_e
October 29 - Group B_e	October 25 - Group F_c
November 16 - Group C_c	November 13 - Group G_e

e Designated as experimental groups.

c Designated as control groups.

The pre-instructional inventory was composed of thirty-six multiple choice questions covering cognitive information about the 16mm motion picture projector, 35mm filmstrip projector, overhead projector, and the audio tape recorder (see appendix B).

There was no textbook used in this portion of the course. The control group had to rely upon the lecture-demonstration for their instruction. The experimental group used printed handouts, slide sets, 8mm film loops, audio tapes and overhead transparencies for their information while developing their psychomotor skills. The information covered was the same for both groups.

There was a post-test (designated as a covariant) administered on the last day of the quarter for both

classes. This occurred on December 4 for the Tuesday-Thursday class and December 5 for the Monday-Wednesday-Friday class.

The post-test was a resequenced version of the pre-instructional inventory.

IX. PROCEDURES FOR TREATING DATA

The pre and post-instructional inventories on cognitive information were scored on IBM marc-sense test sheets and read by an optical scanner for correctness. The resulting data were fed into an IBM 1130 computer in fortran IV programming language and an analysis of covariance was computed.

It was necessary to study the groups as they were because they were intact (already existing) groups and the subjects could not be matched or assigned at random. Analysis of covariance was used because it is a form of analysis of variance that tests the significance of the differences between means of final experimental data by taking into account and adjusting initial differences in the data. It could also give three correlation coefficients one of which could be a best estimate of the true correlation between the measures.[1]

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[1]Fred N. Kerlinger, Foundations of Behavioral Research. (New York: Holt, Rinehart, and Winston, Inc., 1964), pp. 347-351.

The null hypothesis stated that there would be no significant difference between the sample means of the experimental group using self-instructional materials and the sample means of the control group taught by the lecture-demonstration method: $H_o : \bar{X}_e = \bar{X}_c$.

The alternate hypothesis stated that the experimental group would exhibit a significant difference in gain of cognitive information over the control group: $H_a : \bar{X}_e > \bar{X}_c$.

The desired level or significance was set at the .05 level: $P = .05$.

The degrees of freedom were: 152-1+2=149, and 2-1=1.

Table 3

Procedure for Determining the Degrees of Freedom

Source of Variation	Degrees of Freedom
Total	df = N-(1 + number of control variables)
Between	df = Number of Groups - 1
Within	df = df for Total - df for Between

[2]

The critical F ratio was determined by referring to a table for the distribution of F which was F = 3.92.

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[2]W. James Popham and Kenneth A. Sirotnik, Educational Statistics: Use and Interpretation. (New York, Harper and Row, 1967), pp. 216-234.

Chapter II

REVIEW OF LITERATURE

In an article which attempted to secure a rightful place for self-instructional techniques in the teacher education curriculum, Schutz and Baker said that faulty or loosely sequenced self-instruction has proved to have unfortunate effects on both the learning and motivation of students experiencing it. Their experimentation in self-instruction has demonstrated the importance of having a student make responses which are relevant to the end objective. All self-instruction must have behaviorally stated objectives that are clear to the student and obtainable under favorable conditions.[3]

These opinions were stated without supporting evidence in the article cited.

Calder compared five self-instructional methods as students learned the operation of a motion picture projector. Fifty students utilized one of five methods of self-instruction: (1) slides, (2) 8mm single concept film plus slides, (3) slides followed by 8mm single concept

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[3]Richard E. Schutz and Robert L. Baker, "Programed Learning and the Teacher Education Curriculum," Audio Visual Communication Review, ed. W. H. Allen (Washington: Department of Audiovisual Instruction, National Education Association, 1963) Vol. 11, no. 6, pp. 253-259.

film, (4) 8mm single concept film used within a slide sequence, and (5) written instructions and illustrations. All materials were thoroughly tested before use. A score card was used to evaluate student performance and a test was given to study transfer of training.

The results showed no significant differences among the five methods on the performance test but on the test for transfer of training the method using a film within a slide sequence was significantly poorer at the .05 level.[4] The study did not consider lecture/demonstration as one mode of instruction nor did it measure gain of cognitive information.

In an investigation by Curtis Finch, an effort was made to determine the effects of three methods of teaching trouble-shooting to automotive students in a community college program. Forty-five students received initial instruction on ignition principles and were given the Otis Mental Ability Test as a covariant. They were then assigned on a random basis to: (1) equipment oriented instruction, (2) textbook oriented instruction, and (3) programmed texts. After the treatment, all students were given an attitude inventory, knowledge test, and trouble-shooting performance test. An analysis of covariance showed no significant

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[4]Clarence R. Calder, Jr., "A Comparison of the Relative Effectiveness of Five Self-Instructional Techniques in Teaching a Psychomotor Skill," Audiovisual Communication Review, ed. W. H. Allen, Vol. 16, no. 2 (Washington: Department of Audio-visual Instruction, National Education Association, 1968)p. 219.

difference in trouble-shooting, knowledge or attitude toward instruction.

The equipment oriented group required less time and their trouble-shooting ability was significant at the .01 level, which was better than the other two groups. The programmed instruction group yielded the best results for retention of knowledge.[5]

Pratzner and Hanson devised a situation to determine the relative effectiveness of two ways of structuring and presenting twenty-four clock hours of preservice and initial inservice vocational-industrial teacher education lessons. They compared an integrated lecture-discussion course which was presented by a qualified vocational-industrial educator with a packaged course consisting of 16mm film presentation followed by group discussion using guides and materials.

The sample of thirty prospective teachers was randomly enrolled in either summer or fall sections and divided into control and experimental groups. Several analyses were employed and no significant difference between the methods was noted.[6]

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[5]Curtis R. Finch, "Self-Instructional Methods of Teaching Diagnostic Problem Solving to Automotive Students," ERIC NO. ED 030735 (Vocational-Industrial Education Research Report, Pennsylvania State University, 1969), 114 p.

[6]Frank C. Pratzner and Majory Hanson, "The Relative Effectiveness of Two Ways of Structuring and Presenting Preservice and In-service Vocational-industrial Teacher Education Lessons," ERIC NO. 02995 (Minnesota Research Coordinating Unit in Occupational Education, Minneapolis, 1969), 20 p.

An attempt was made to measure differences in learners caused by audio tape lessons and lectures in a community college social science class. Three measures were used to evaluate the procedure: (1) Allport-Vernon-Lindsey study of values, (2) scores on Sequential Test of Educational Progress and (3) final course grades. The usual pre-test and post-test were administered and no significant difference was noted. However, there were lower drop-outs from the audio tape lessons than from the lecture classes. A replication of the study yielded the same results.[7]

Strang investigated the effectiveness of several inexpensive media applications as self-instructional aids in teaching a typical vocational skill. Skills involved in automobile distributor repair were analyzed and broken down into 20 sequential behavioral units. Eleventh and twelfth grade boys were randomly selected who had no prior knowledge of these skills involved. Still pictures in the form of two by two slides and printed text were used as self-instructional material. Instructor help was given if the student asked for it or looked puzzled. The second group used slides with pre-recorded audio synchronized with each slide. The third group could use either

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[7]Vernon L. Hendrix, "Comparison of Audio Tape and Lecture Procedures in Social Science 131" ERIC NO. ED 029636 (Dallas County Junior College District, Dallas, 1968), 9 p.

the slide-print mode or the slide-oral mode.

A single factor ANOVA found that there was a significant difference in retention of information at the .05 level by the slide-oral group. They required less prompts from the instructor. However, those using slides and printed materials needed less time to complete the instructional sequence.[8]

The most notable use of lecture, demonstration, and self-instruction has been developed by S. N. Postlethwait at Purdue University in the early 1960's. The success that he enjoyed led him to completely structure all botany courses according to his audio tutorial approach to learning. His technique employed: (1) independent study sessions, (2) general assembly sessions, (3) small assembly sessions, and (4) other activities.

A variety of materials, equipment, and specimen were used in a self-instructional mode so that the student could progress at his own rate without the usual time constraints. Self-instruction integrated with large assembly sessions and small assembly sessions, quizzes, and other activities has produced phenomenal results in student achievement.

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[8]Harold R. Strang, "Pictorial and Verbal Media in Self-Instruction of Procedural Skills," Audiovisual Communication Review, ed. W. H. Allen, Vol. 21, no. 2 (Washington: Association for Educational Communication and Technology, National Education Association, 1973) pp. 225-232.

When using criterion referenced tests instead of norm referenced tests to determine gain in knowledge, failures have been reduced to a very low level and in some instances eliminated altogether. Opinion surveys have upheld student preference for the audio-tutorial technique and greater contact between student and instructor has been achieved.

The evaluation criterion normally employed by Postlethwait and his associates showed that 90 percent of the students achieved 90 percent of the behavioral objectives set for any one segment of the course being taught.[9]

A vast number of studies has been conducted on the audio-tutorial techniques developed by Postlethwait and his disciples showing that learning situations structured in similar fashion will produce statistically positive results.

If it can be proved statistically that students learn just as well or better from self-instructional techniques as from regular classroom lecture-demonstration, then our proposed competency-based program will benefit from this finding.

Pascal attempted to show the relationship between

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[9]S. N. Postlethwait, J. Novak, and H. T. Murray, Jr., The Audio-Tutorial Approach to Learning. (Minneapolis: Burgess Publishing Company, 1972), pp. 110-129.

individual differences and a preference for instructional methodology by providing three options in instructional mode and then evaluating the outcome. He organized classes that were taught by (1) lecture only, (2) lecture with discussion, and (3) independent reading. He used 185 students in a psychology class and administered an anxiety questionnaire, an omnibus personality inventory, and a test for general information using pre and post forms.

The results were significantly different in several areas. He concluded that the independent study group had greater need for autonomy, flexibility, a higher tolerance for ambiguity and a greater preference for abstract and scientific thinking than students in the lecture group.[10]

This study pointed out that there are propensities for different teaching methodologies and that certain types of students fair better under certain conditions and instructional methods than others.

SUMMARY

Generally speaking, self-instruction was shown to be as effective and in some instances superior to the conventional lecture-demonstration methods of

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[10]Charles E. Pascal, "Individual Differences and Preference for Instructional Methods," ERIC NO. 059971 (McGill University, Montreal, 1971), 22 p.

instruction. An extremely important factor was the type of material used for the self-instructional mode. It was implied that much care needed to be exercised in sequencing aural-visual stimuli.

Another implication, yet less research than other factors, was that student preference for one mode over another could greatly affect the outcome of any teaching-learning strategy.

Many studies theorized that economies of time, effort, and effectiveness were the biggest pay-off in instructional considerations rather than having a research design that proved mediated self-instruction was superior statistically to other methods.

Chapter III

REPORT OF THE STUDY

On the initial class meeting for both sections of the course 3470, the students were divided into four groups in each of the two classes. Two groups in each class were designated as control groups and two were designated as experimental. These were: Groups B, D, E, and G experimental and groups A, C, F, and H control.

According to the way in which the classes have been taught, group D was the first to study the instructional hardware module during the initial two and one-half weeks on Monday-Wednesday-Friday and group H was the first on Tuesday-Thursday. All subsequent groups rotated into and out of the module according to plan.

On the first day of class when each group rotated into the hardware module, the students were given a pre-instructional inventory composed of thirty-six multiple choice items. These were scored on an IBM marc-sense test sheet. All test items had been validated on previous examinations to other subjects.

After the pre-instructional inventory, the control group was given lectures and demonstrations on the four hardware items. A handout listing the behavioral objectives for the module was given to the control subjects.

They were instructed on operational procedures, simple maintenance, and utilization techniques. A different piece was introduced on each of the first four class sessions.

The control subjects were allowed to go to the self-instructional equipment operations laboratory only on Wednesdays and Thursdays during their two and one-half weeks period in the hardware module. They were to practice operating the pieces of hardware until they felt confident to pass a skills test administered by student workers who maintained the facility. They could receive help in the lab from the instructor and student workers.

The skills test consisted of a check list that had all operating procedures listed on it and the subject was to perform according to standard procedure. The student worker observed and marked tne check list as each function was performed and asked relevant questions about its maintenance and utilization. The test situation was either pass or fail. No penalty was imposed for failure, but the subject was allowed to take it again whenever he felt ready.

All subjects waited until the last day of the quarter to take the post test.

The experimental group was given the pre-instructional inventory on their first day in the hardware module. Before the first period was concluded, they were briefed on how they

were to proceed.

They were taken to the lab and shown what four hardware items they were to practice on. They were given a handout that consisted of behavioral objectives for the module, step by step procedures on what they were to do, and were shown what self-instructional media were available to them. The media consisted of: (1) a slide set on 16mm motion picture projector operations, (2) an 8mm silent film loop on 16mm projector operations, (3) a slide set and audio tape on magnetic tape recorder operations, (4) an 8mm silent film loop on magnetic audio tape recorder operations, (5) company published operating manuals on the tape recorders, (6) a quasi-programmed manual on filmstrip projector operations, (7) company published operating manuals on the filmstrip projectors, (8) company operating manuals on the overhead projectors, and (9) overhead transparencies on the overhead projector.

This allowed enough variety to satisfy most individual preferences, for example, prints, visuals, audio, et cetera.

The experimental group could only attend the lab on Mondays and Tuesdays during their two and one-half weeks period in the module. All self-instructional media was removed on Tuesday afternoons before the control group came into the lab on Wednesdays and Thursdays.

The experimental group was instructed not to ask for help from the student workers who were to observe and administer the skills tests.

A roster of both groups was kept in the lab and as each subject came in, the roster was checked to see if they were coming in on their assigned days.

If any of the students in either group did not complete the four skills tests on time, they were allowed to come back into the lab on subsequent weeks until they were completed. Practically all students completed the skills tests within the allotted time frame.

On the last day of the quarter for each class, the post-instructional inventory was administered. It was the same as the pre-instructional inventory except for preliminary instructions. The test was scored on an IBM marc-sense test sheet and read by an optical scanner. This test for cognitive information was the dependent variable used to calculate an analysis of covariance.

The computation was carried out on the IBM 1130 computer from a statistical package developed for faculty and student research on the campus of East Tennessee State University.

The total number of subjects used in the experiment was one hundred fifty-two, $N = 152$. There were seventy-eight in the control group, $N_c = 78$, and seventy-four in the experimental group, $N_e = 74$.

The complete computation is indicated in an analysis-of-covariance table.

Table 4

Analysis of Covariance

	df	ΣX^2	ΣXY	ΣY^2	df	$\Sigma Y'^2$	Mean Square
Among Means	2	74.33	185.67	463.78	1	325.29	325.29
Within Groups	149	2145.00	793.76	2465.20	149	2171.28	14.57
Totals	151	2219.34	979.43	2928.80	150	2496.57	

The computed F value was $F = \frac{325.29}{14.57} = 22.32$ and the critical F value was $F_{.95}(1,149) = 3.92$.

The mean square for the among means calculation was 325.29 and the mean square for the within groups calculation was 14.57. When these were divided, an F ratio of 22.32 was obtained. The critical F ratio at 1 and 149 degrees of freedom was 3.92.

The test for significance shows that the test for a difference in means far exceeds the P = .05 level. Therefore, the null hypothesis $H_o : \bar{X}_e = \bar{X}_c$ was rejected and the alternate hypothesis $H_a : \bar{X}_e > \bar{X}_c$ was accepted.

Even when a test for significance of differences in the Y means not making use of the X values, it gave a ratio which exceeded the P = .05 level. The calculated differ-

ence was: $F = \frac{463.78/2}{2465.20/149} = \frac{231.89}{16.54} = 14.01.$

The critical F ratio was: $F_{.95} = (2,149) = 3.06.$

It was concluded that the experimental group which received the treatment utilizing a self-instructional technique made greater achievement gains in acquisition of cognitive information over the control group utilizing the lecture-demonstration method.

Chapter IV
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

An experiment was conducted in a pre-service teacher education course, Education 3470, Materials for Teaching, to determine whether or not students would gain more cognitive information while developing psychomotor skills when using self-instructional techniques as compared with those students using a traditional lecture-demonstration method.

The students enrolled for the course were given a pre-instructional inventory consisting of thirty-six multiple choice items. The module of instruction covered four pieces of instructional hardware operations, preventive maintenance, and utilization techniques.

Both the experimental and control groups were assigned specific access time to the self-instructional lab where all equipment was housed. They were to practice until they were confident that they could pass an operational skills test administered by student workers who maintained the laboratory.

They were allowed two and one-half weeks to complete the module, but additional time was given if it

was needed.

After all groups had rotated into and out of the module during the quarter, a post test was administered on the last day of the quarter. The answers were marked on IBM marc-sense test sheets, read by an optical scanner, and the data fed into an IBM 1130 computer for computation of an analysis of covariance.

CONCLUSIONS

The analysis of covariance made adjustments for inequalities between the experimental and control groups since they were not randomly selected or matched pairs. The computation showed that the experimental group achieved a greater gain in cognitive information over the control group at the .05 level of significance. Therefore, the null hypothesis, $H_o : \bar{X}_e = \bar{X}_c$ was rejected and the alternate hypothesis was accepted, $H_a : \bar{X}_e > \bar{X}_c$.

It was concluded that mediated self-instruction was superior to the lecture-demonstration method in so far as the experiment was structured. To generalize beyond the parameters of the experiment must be done cautiously.

RECOMMENDATIONS

In view of the planned conversion of traditional curricula in the College of Education at East Tennessee State University to curricula which are competency-based,

the following recommendations can be offered concerning some mediated teacher-learning strategies:

1. Additional studies should be undertaken to determine if students can experience greater gains by using self-instructional techniques in other combinations of the cognitive, affective, and psychomotor domains

2. An investigation of cognitive mapping, a theoretical method to determine student propensities for teaching-learning strategies, should be made in order to provide a greater student success-failure ratio

3. Studies should be conducted to determine the more efficient types of media to be used in self-instructional situations

4. A cost-study analysis should be conducted to determine whether mediated self-instructional techniques are less expensive per student over a given period of time than traditional methods of teaching

5. Students should be given the opportunity to experience more self-instructional situations in order to prevent an academic future-shock when the College of Education converts its curricula to a competency-based technique

6. Instructional materials, both print and non-print, must be tested and revised before wholesale student use

7. Additional instructional hardware needs to be purchased on the basis of pre-determined instructional

strategies that will provide the greatest amount of individualization to the greatest number of students

8. Adequate supportive staff in non-print media production will be needed to augment a self-instructional program

9. The use of peer tutors to help those students who are reluctant to assume responsibility for their own instruction will need to be provided

10. Provision for greater access to individual study carrells will need to be created

11. Faculty planning for instructional goals will need to be undertaken several months in advance of initial student participation in the self-instructional program

12. Follow-up studies to determine the amount of retention over given time periods should be undertaken

13. Whenever students have had experience in using self-instructional techniques, inventories should be conducted and student opinions sought so as to improve the program

14. Faculty briefing on research findings should be held and additional faculty research into self-instructional techniques be encouraged.

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APPENDIX A

MEMORANDUM

To: All teachers of Education 3470 -- All Curriculum E and Curriculum S Students

From: Clyde L. Orr, Chairman, Department of Education

Re: Education 3470 (Materials for Teaching)

Education 3470 will consist of four units of a designated number of days for each section, as follows:

1. Library Science
2. Operation of Instructional Hardware
3. Educational Statistics
4. Textbooks and Community Resources

The course, as it appears on the schedule, merely represents the place to meet the class time on the first day; and the name of the teacher who will average and turn in the grades for that section.

Each class scheduled will be divided into four groups, and each group will be assigned a letter to distinguish it, at the first meeting of the class. One group will begin the quarter by studying the Library Science Unit, one the Operation of Instructional Hardware, one Educational Statistics, and one Textbooks and Community Resources.

Each division of the quarter, each group will complete

one of the units, be graded on it by that instructor and move on, in a regular specified order, to another unit and a different instructor.

Thus, each student will earn four grades, which will be considered of equal value. The four grades will be summed and scaled and constitute the final or course grade. The basis for converting total scores to a letter grade follows:

93 through 100 = A
85 through 92 = B
77 through 84 = C
69 through 76 = D
0 through 68 = F

TEXTBOOKS

There are no basic texts for the sections on Library Science, Textbooks and Community Resources, and the Operation of Instructional Hardware. Appropriate "handouts" will be provided by instructors of these sections covering all essential skills to be taught.

It is advisable (but not required) that each student buy, or have available, the little paperback: Introduction to Descriptive Statistics and Correlation, by McCollough and Van Atta, which is available on the open shelves in the bookstore, at a price of about $2.95.

If you have further questions, ask any of the professors involved with any part of the course.

Memo: Education 3470

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FALL QUARTER, 1973

System for dividing and moving sections of Education 3470 through the four units of the course.

Section 1: 506-3470-001 - 5th period MWF; class meets 31 times.

DIVIDE ORIGINAL SECTION INTO GROUPS A, B, C, D

Send Group A to Room E403 - Dr. R. Shepard
Send Group B to Room E407 - Dr. E. Farrell
Send Group C to Room L415 - Miss D. Baird
Send Group D to Room E203 - Mr. L. Garcia

Dates for meeting with each instructor: 5th period MWF - Section 001

First 8 days - 9/21, 9/24, 9/26, 9/28, 10/1, 10/3, 10/5, 10/8
Second 7 days - 10/10, 10/12, 10/15, 10/17, 10/19, 10/22, 10/24
Third 8 days - 10/29, 10/31, 11/2, 11/5, 11/7, 11/9, 11/12, 11/14
Fourth 8 days - 11/16, 11/19, 11/21, 11/26, 11/28, 11/30, 12/3, 12/5*

Section 001 - (MWF)

Meeting places for lettered sections, by eight-and seven-day periods:

	1st 8 days	2nd 7 days	3rd 8 days	4th 7 days
E403	A	B	C	D
E407	B	C	D	A
L415	C	D	A	B
E203	D	A	B	C

* On December 5th all students in 506-3470-001 will meet in Room E409 for a final examination in Instructional Communications.

Memo: Education 3470

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FALL QUARTER, 1973

System for dividing and moving sections of Education 3470 through the four units of the course.

Section 2: 506-3470-002 - 6th period TX, class meets 21 times

DIVIDE ORIGINAL SECTION INTO GROUPS E, F, G, H

Send Group E to Room E403 - Dr. R. Shepard
Send Group F to Room E407 - Dr. E. Farrell
Send Group G to Room L415 - Miss D. Baird
Send Group H to Room E203 - Mr. L. Garcia

Dates for meeting with each instructor: 6th period TX - Section 002

First 5 days - 9/20, 9/25, 9/27, 10/2, 10/4
Second 5 days - 10/9, 10/11, 10/16, 10/18, 10/23
Third 5 days - 10/25, 10/30, 11/1, 11/6, 11/8
Fourth 6 days - 11/13, 11/15, 11/20, 11/27, 11/29, 12/4*

SECTION 002 (TX)

Meeting places for lettered sections, by five- and six-day periods:

	1st 5 days	2nd 5 days	3rd 5 days	4th 5 days
E403	E	F	G	H
E407	F	G	H	E
L415	G	H	E	F
E203	H	E	F	G

*On December 4th all students in 506-3470-002 will meet in room E409 for a final examination in Instructional Communication.

APPENDIX B

3470 - MATERIALS FOR TEACHING

INSTRUCTIONAL COMMUNICATIONS SECTION

PRE-INSTRUCTIONAL INVENTORY

Directions. Read each question, select what you believe to be the best answer, use a # 2 lead pencil and mark the test answer sheet at the appropriate place. It will be to your advantage to guess if you do not know the answer. Those scoring high enough on this inventory will not have to take the final examination.

16MM MOTION PICTURE PROJECTION:

1. When the projected image from a 16mm projector is fluttering on the screen, the probable cause would be (1) film too small (2) projector parts are loose (3) torn film sprocket holes (4) film loops are too large.

2. If the image from a 16mm projector does not have the sound synchronized with lip movement what can be done to correct it? (1) turn off the sound until the image catches up (2) stop the projector and adjust the lower film loop size (3) turn off the projection light until the sound catches up (4) stop, rewind the film and start over.

3. Which part of the 16mm projector listed below does not need frequent cleaning? (1) lenses (2) film channel (3) sprocket teeth and wheels (4) snubber roller.

4. The lamp that helps produce sound when projecting a sound motion picture film is: (1) exciter (2) projection (3) pilot (4) infrared.

5. The film comes off the supply reel in what direction? (1) counter clockwise (2) clockwise (3) backwards (4) tail-end first.

6. When using a standard projection lens in a 16mm projector, how can the image on the screen be reduced in

size? (1) move the screen farther away from the projector (2) change the screen to a different size (3) move the projector farther from the screen (4) reduce the distance between projector and screen.

7. The lens system used to take light and focus it through the film is called (1) projection lens system (2) contact lens system (3) condenser lens system (4) focussing lens system.

8. What is the projection speed for sound 16mm motion pictures? (1) 26 FPS (frames per second) (2) 24 FPS (3) 18 FPS (4) 16 FPS.

9. When using a silent 16mm film and a loud, rapid popping noise is heard, the best way to eliminate this noise would be to (1) turn off the amplifier switch (2) change projection speeds (3) press the reset button (4) stop, and rethread the film.

10. When the 16mm projector is in the still frame mode, what prevents the film from burning in two due to excessive heat caused by the projection lamp? (1) the condenser lens gets darker (2) the projection lens diverts the light (3) a filter absorbs the excessive heat (4) the projection lamp gives off less light.

OPEN REEL AUDIO TAPE RECORDING

11. As one faces the tape recorder, the feed reel (one with tape) should be placed on which side of the transport system (1) top (2) left (3) right (4) bottom.

12. What type or kind of signal is placed onto the tape by the recording head? (1) electrical (2) kinetic (3) magnetic (4) potential.

13. Which of the following <u>will not</u> cause permanent damage to audio tapes? (1) frequent head cleaning (2) stacking them on top of each other (3) excessive heat or moisture (4) storing near electric motors or electric wiring.

14. To prevent sound distortion when tape recording one should (1) adjust the tone control properly (2) place the monitor switch to on (3) erase each tape before recording (4) adjust the volume control to a proper level by watching the VU meter.

15. One should not plug the microphone into the radio-phono patch receptacle to produce an acceptable

recording because (1) the mic patch cord will not fit (2) of high voltage problems (3) the mic is a high impedance imput (4) the patch cords are not the same.

16. The tape recorder speed best suited for music of the highest fidelity is (1) 7 1/2 IPS (2) 3 3/4 IPS (3) 1 7/8 IPS (4) 3/4 IPS.

17. Dubbing on the audio tape recorder is (1) recording on track two (2) recording in stereo (3) recording from a phono, radio, etc. (4) splicing out bad sounds.

18. To be able to hear what goes onto the tape during a recording session, one needs to (1) connect two recorders together (2) use sound-on-sound (3) disconnect the microphone (4) turn on the speaker switch and monitor with headphones.

19. The best method for cleaning an audio tape recorder is to (1) use a cleaning tape (2) use a commercial cleanser and "Q" tips (3) immerse tapes in alcohol regularly (4) use compressed air to blow away grit.

OVERHEAD PROJECTION

20. The overhead projector should be located (1) at the same level as the teacher's desk top (2) on top of the teacher's desk (3) in the middle of the room (4) on a 42" projection cart.

21. The Fresnal lens serves to (1) invert the image (2) hold the transparencies (3) focus the image onto the screen (4) direct light to all areas of the work stage.

22. The condition caused by the projected image being narrower at the bottom than at the top is called (1) horizontal keystoning (2) vertical keystoning (3) oblique keystoning (4) keystoning.

23. The switch on the overhead projector that allows the fan to continue to run after the lamp is turned off is called (1) three positional switch (2) toggle switch (3) thermal switch (4) interlock switch.

24. The operator's position in relation to the class and the projector should be (1) near the screen (2) standing beside the projector (3) at the back of the room (4) seated beside the projector.

25. The optical part that requires the most care in cleaning is the (1) projection lens glass (2) Fresnel lens (3) first-surface mirror (4) aperture glass (work stage).

26. What part of the projector may be damaged by overheating (1) Fresnel lens (2) workstage aperture (3) projection lens (4) focussing mechanism.

27. What kind of material may not be used on the overhead projector (1) transparent materials (2) photographic prints (3) translucent materials (4) transparent models.

FILMSTRIP PROJECTION

28. If the filmstrip is too large for the cartridge (1) remove cartridge and lay filmstrip in depression (2) change to another type of projector (3) re-roll the filmstrip into a tighter roll (4) cut filmstrip to size.

29. To show slides with the Bell and Howell filmstrip projector, one needs to (1) install a slide changer (2) lower the film channel and insert slide (3) change to a different type projector (4) put slides into grey cartridge .

30. When setting up the filmstrip projector, one needs to pre-focus by (1) elevating the projector (2) adjusting the tilm mechanism (3) projecting a few frames of a filmstrip (4) turning on projector and getting a sharp lighted area on screen.

31. A filmstrip is moved through the projector by means of (1) gravity (2) a metal spring (3) sprocket holes and teeth (4) the grey cartridge system.

32. To correct for a split-frame one must (1) adjust the focussing knob (2) press the remote control "forward" button (3) pull the filmstrip forward or backward (4) adjust the film advance knob.

33. The glass heat filter is located (1) in the condenser lens system (2) in the projection lens system (3) in the motor housing (4) at the film channel aperture.

34. Which function can the remote control not perform (1) forward (2) reverse (3) focus (4) rewind.

35. The purpose of the aperture is to (1) allow light to

pass through the film (2) allow one to see the next frame coming up (3) prevent the film from hanging up (4) provide a means for air to circulate and cool the projector.

36. To insure that the filmstrip feeds into the projector properly from the cartridge (1) place the tail end to the outside of the coil (2) place the beginning of the filmstrip to the outside of the coil (3) use the filmstrip as the producer suggests (4) trim the filmstrip squarely across at the leading edge.

APPENDIX C

3470 - MATERIALS FOR TEACHING

INSTRUCTIONAL COMMUNICATIONS SECTION

POST TEST

Directions. Read each question, select what you believe to be the best answer, use a # 2 lead pencil and mark the test answer sheet at the appropriate place. It will be to your advantage to guess if you do not know the answer. Place your last name, given name, middle initial in the top right hand corner of the test answer sheet.

The questions in the post test were identical to those given in the pre-instructional inventory.